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DesignBuilder and EnergyPlus

DesignBuilder Software

Mission: "To provide state-of-the-art building modelling tools in a package accessible to all."

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DesignBuilder is a software tool for creating building models and generating visual, thermal and lighting performance data. Its innovative productivity features allow even complex buildings to be modelled rapidly by non-expert users. Internally, DesignBuilder uses the state-of-the-art thermal simulation engine EnergyPlus to generate its thermal performance data.

Visualisation and shading

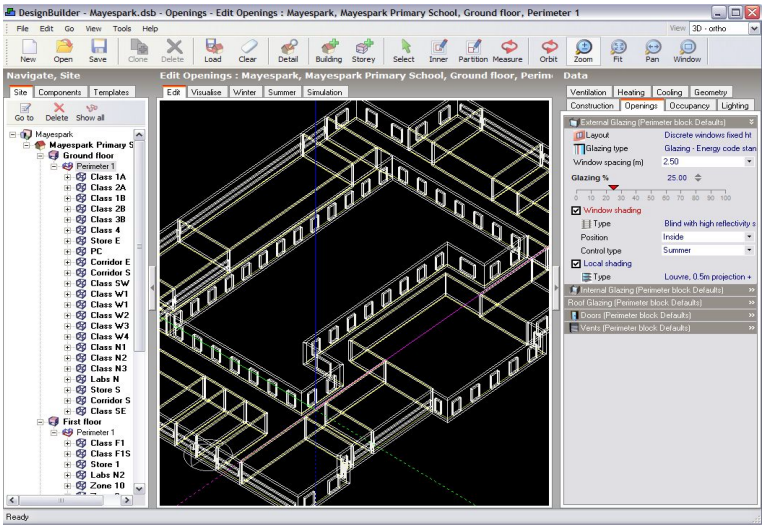
Uniquely, DesignBuilder provides full control over the model detail. The whole building may be modelled or, for more precision, you may concentrate on a single zone. Or you can create a model with a very simple definition of construction but put considerable detail in each item of installed equipment.

These features allow DesignBuilder to be used effectively at any stage of the design process, from the concept stages where just a few parameters are needed to capture the building design, to much more detailed building models for established designs (or existing buildings).

Data templates allow you to load common building constructions, activities, HVAC and lighting systems into your design by selecting from drop-down lists.

User Interface and Modelling Features

The result of a considerable R&D programme over the last four years, DesignBuilder combines next-generation solid modelling technology with the latest simulation techniques to provide a powerful yet intuitive building-modelling tool. At the core of the program is the OpenGL geometric modeller, which allows building models to be assembled by positioning "blocks" in 3-D space. Blocks can be any shape and can be positioned adjacent to each other or in isolation. Once placed, blocks can be moved at will and divided up into zones simply by drawing the partition walls. Working with realistic 3-D solids (rather than abstract lines) provides visual feedback of actual element thickness and allows accurate calculation of floor areas and volumes.



OpenGL geometric modeller with explorer (L) and attribute editor (R)

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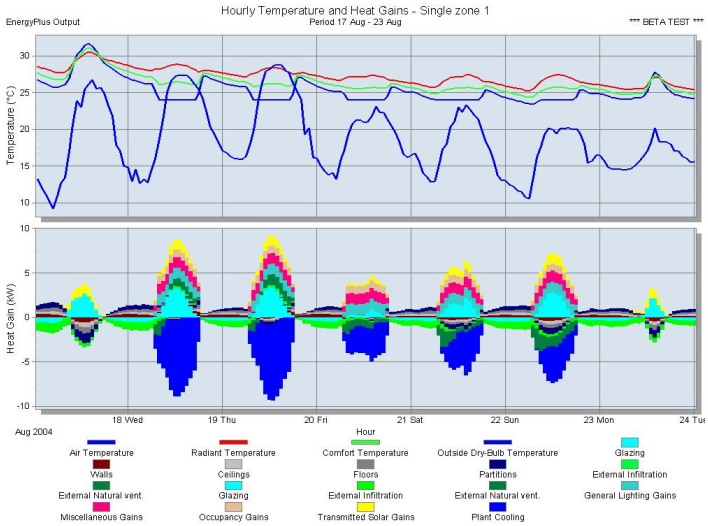
You can also create your own templates if you often work on similar types of buildings. This, combined with data inheritance, allows global changes to be made at building, block or zone level.

Performance and design data

Display of environmental performance data is tightly integrated with the model edit screens and any calculations and/or simulations required to generate the data are started automatically. This means that you can concentrate on your modelling work without the distraction of running external modules and importing data. The following data can be shown in annual, monthly, daily, hourly or "sub-hourly" intervals:

- Energy consumption broken down by fuel and end-use.
- Internal temperatures, including temperature distribution charts.
- Weather data
- Heat transmission through building elements including walls, roofs, infiltration, ventilation etc.
- Heating and cooling loads.
- CO2 generation.

Heating and cooling plant sizes can be calculated using design weather data and a choice of calculation methods (EnergyPlus, 3TC, CIBSE admittance).

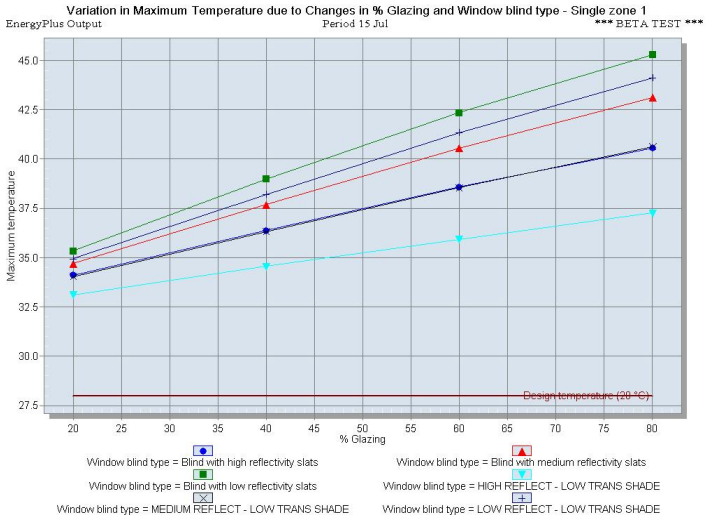


Hourly temperature and fuel consumption data for seven days

Performance comparisons

An important part of most modelling projects is to compare the performance of different building configurations. This is especially true in the early stages of the design process when the design is still fluid. DesignBuilder has built-in features to facilitate such comparisons:

- 'Bookmarks' mark multiple points in the design flow, allowing you to return to previous designs and also to compare performance data among all bookmarked designs.
- The parametric analysis facility allows you to investigate the effect of variations in design parameters on a range of performance criteria, simply by selecting the parameters to vary from drop-down lists (picture right).



Parametric analysis chart showing the effect of various facade designs on the maximum summertime temperature

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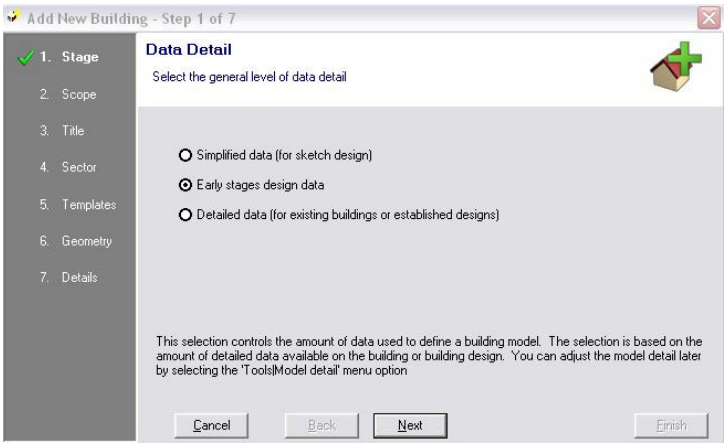
- A stock management capability, which allows buildings to be grouped together and modelled en masse.
- Energy-saving measure scenarios can be applied to the stock and the performance for each scenario reported. This feature will be of particular interest to holders of building stock portfolios to assist with policy development, stock aggregation and other research activities.

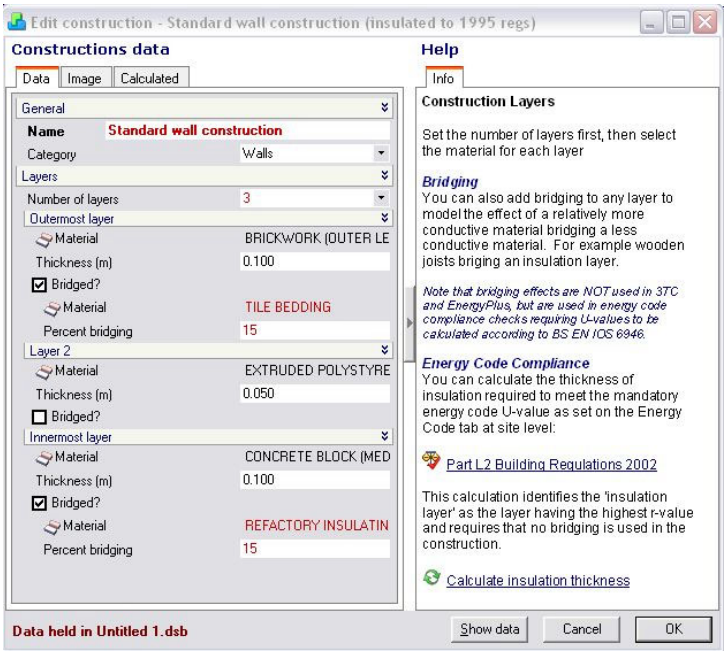


Add New Building wizard showing three basic model detail options

EnergyPlus Features Implemented

DesignBuilder implements all of the EnergyPlus fabric and glazing data input, providing databases of building materials, constructions, window panes, window gas, glazing units and blinds. Also implemented are:

- Shading by louvres, overhangs and sidefins as well as internal and mid pane blinds.
- COMIS natural ventilation with the option for windows to open based on a ventilation set point temperature. Crack sizes can either be calculated based on an airtightness setting or can be entered explicitly.
- Lighting control systems and calculating savings in electric lighting allow checking for optimal use of natural light.
- Heating and cooling load calculation using the "purchased air" system.
- Schedules using intervals of 60 to 6 minutes.
- Holidays - select the number of days per year and the local holiday schedule.



Edit Construction dialogue showing tool to calculate the insulation thickness for compliance with the local energy code

- There are no limitations on surface shape – surfaces having more than four vertices are triangulated to ensure compatibility with the EnergyPlus simulator.

- Nearly 1500 ASHRAE worldwide design weather data sets are included with the software and more than 580 EnergyPlus hourly weather files are available free on demand.

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Uses and Users

DesignBuilder is suitable for use by architects, building services engineers, researchers, energy consultants, and students. Some typical applications are:

- Evaluating a range of façade options for the effect on overheating, energy use and visual appearance.
- Checking for optimal use of natural light, modelling lighting control systems and calculating savings in electric lighting.
- Visualisation of site layouts and solar shading.
- Thermal simulation of naturally ventilated buildings.
- Calculating heating and cooling equipment sizes.
- Communication aid at design meetings.
- Educational tool.
- Evaluating energy-saving measures on individual buildings or multiple buildings in a portfolio.

Availability and Cost

DesignBuilder v1.0 development is nearing its final stages and we expect to release a new beta version soon. If you would like to take part in the beta tests (and you haven't already registered by downloading the early beta test versions 0.3.x) please email sales@designbuilder.co.uk.